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Review

Stability and climate policy? Harnessing insights on path dependence, policy feedback, and transition pathways

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ABSTRACT

Instilling climate policy with stability has emerged as a central concern in both the academic literature and societal discourse around climate change. Societal actors have called for stable climate policy to enable low-carbon investment; decisionmakers have sought to provide credible signals; and scholars have developed insights to inform "stickier" instrument design. However, given the sources of instability confronting climate policy and the transformative changes entailed by decarbonization, this paper argues that climate policy stability may not only be unattainable but also undesirable. Instead of striving for stability as an overriding feature of climate policy, we suggest attending to a broader aim: *stabilizing the overarching orientation of climate policy as a transition towards a low greenhouse gas emission economy*. We review the complementary concepts of path dependence, policy feedback, and transition pathways to distill strategies that may help in addressing this aim.

1. Introduction

Instilling climate policy with *stability* – often referred to interchangeably as *durability*, *stickiness, predictability*, *certainty*, or even *credibility* – has emerged as an overriding concern in both the academic literature and societal discourse around climate change. Prominent business leaders, public officials, and environmental advocates tend to point to climate policy stability as a crucial precondition for the rapid mobilization of significant financial flows to reorient the economy along a low-carbon trajectory [1]. Industry leaders have called for "sound policy certainty" [2] and "stable, reliable and economically meaningful carbon pricing" [3,4]. Among policymakers, "durability is perceived to be *the* Holy Grail of climate policy design" [5]. In this view, stable climate policy offers a credible signal to redirect individual behavior and business models toward low-carbon alternatives [6].

Yet, despite recognizing the importance of providing stable and credible signals, climate policy frameworks continue to undergo considerable and unpredictable change. Climate policies and targets appear to be particularly susceptible to reversal as political administrations change, falling prey to the vicissitudes and opportunism of party politics [7,8]. This instability introduces investment risk in carbon abatement as rules and regulations may change abruptly, leaving low-carbon assets without an economic rationale. Complete reversal is, however, not the only way in which climate policy instability manifests. Defunding critical programs, failing to move to implementation, and not enforcing rules, among other issues, may also erode policy signals and objectives [9,10].

In response, a rich body of scholarly work on climate policy stability has emerged with links to diverse theoretical perspectives. In their seminal paper on the "super wicked" challenge climate change presents for policymaking, Levin et al. [11] draw upon insights from the literature on *path dependence* in an attempt to imbue climate policy with stickiness – i.e., limit reversibility, entrench support over time, and expand support for the policy. They propose leveraging the same path dependent processes that are often viewed as locking in established carbon-intensive arrangements [12] in order to instil low-carbon policy interventions with greater durability in such a fashion as to address the climate challenge. Several studies have been inspired by this work, seeking to use path dependent forces such as increasing returns, feedbacks, and lock in [13,14] to promote climate policy stability [10,15]. Matt and Jordan ([16] p.229), for instance, investigate "the scope for intentionally designing policies that are sustained by positive feedback and/or are resilient to negative ones". While their work focuses on the mechanisms that may promote or undermine stickiness in climate policy, they also consider the importance of building in flexibility so that policies can adapt to unpredicted external changes. Related work emphasizes the role of feedbacks in creating more stable climate policy. Lockwood [8], for example, examines the implementation of the UK

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Climate Change Act and finds that it remains at risk of reversal given that group identities, affiliations, and investments have yet to seriously shift in such a way as to begin to entrench the policy politically. Others have investigated how low-carbon policies [17] and technologies [18] can create their own positive (or negative) feedbacks and generate (or hinder) support for more ambitious climate policy interventions over time. More recently, Bernstein and Hoffmann [19] enrich earlier work by distilling a set of political mechanisms (normalization, capacity building, and coalition building) through which low-carbon interventions become more difficult to reverse as time passes.

Still others have tackled the issue of climate policy (in)stability by more formally exploring opportunities for mutual enrichment among diverse theoretical traditions. Lockwood et al. [20] seek to translate the lessons from historical institutionalism (e.g., on path dependence and feedback) to the field of sustainability transitions [21]. Similarly, Kern and Rogge [22] review policy process theories (including research on policy feedback), with the aim of enriching perspectives on sustainability transitions. A research agenda has also recently been proposed, which combines insights from sustainability transitions, policy analysis, and political science, drawing out core themes spanning from coalitions, to feedbacks and stability, to context dependence [23].

While the abovementioned works have shed considerable light on the processes and mechanisms driving both stability and instability in climate policy, we take a somewhat different approach. First, we seek to combine three complementary concepts that have shown promise in addressing issues of stability and instability in the context of decarbonization: *path dependence*, *policy feedback*, and *transition pathways*. Although others have already begun to explore opportunities to integrate the different literatures from which these concepts originate, less has been done to explicitly draw together the three abovementioned concepts to confront the climate challenge (to be sure, path dependence and feedback are already linked as they emerge from similar strands of research). So, rather than more formally reviewing the different literatures and theories from which these concepts emerge as others have done, we build on these efforts by reviewing conceptual connections, deepening linkages, and drawing lessons.

Second, and most importantly, the starting point for this analysis is that the stability of individual climate policies and instruments may not only be unattainable but undesirable in the context of the transformative changes required to decarbonize society (we return to this in detail in the next section). Instead, we suggest attending more closely to a broader aim: *stabilizing the overarching orientation of climate policy as a transition towards a low greenhouse gas emission economy*. The emphasis is, therefore, not on making individual policies or even mixes of specific measures sticky but rather on avoiding the reversal or erosion of the overarching direction of climate policy as moving society toward a low-carbon course of development.

It is this goal that motivates our analysis and raises two central research questions. First, what can the concepts of path dependence, policy feedback, and transition pathways tell us about stabilizing the overarching climate policy orientation in order to avoid the reversal or erosion of the low-carbon course of development? Second, through which strategies might this policy orientation be instilled with greater "stability, coherence, and integrity as time passes, achieving its basic promised goals [i.e., decarbonization] amid the inevitable vicissitudes of politics" ([24]p.207)?

In order to engage with these interrelated questions, this paper first addresses the sources of climate policy instability and why stability may be at odds with the nature of the low-carbon transition. The analysis then moves to survey three complementary concepts: path dependence, policy feedback, and transition pathways. After exploring these concepts, we distill prominent strategies that may help with stabilizing the overarching orientation of climate policy as a low-carbon transition. The analysis concludes with additional reflections on these strategies and future research.

2. Climate policy instability and the transformative nature of the low-carbon transition

It has long been understood that climate change represents a particularly difficult – even "super wicked" – policy problem [11]. Although distinct analyses and perspectives may highlight slightly different structural elements of the climate challenge (consider [25–27], and [11] for useful discussions), several features are typically given prominence. The first relates to *operative timeframes*. Climate change is playing out over multiple decades and even centuries as greenhouse gas emissions have been accumulating since the industrial revolution, and the impacts of current emissions will be felt far into the future, particularly if the climate system passes critical thresholds [28]. A credible policy response requires that costs be borne today in order to avoid ever more serious consequences in the future [29]. Yet, political systems oriented towards short-term economic and political cycles are poorly adapted to address the long-term nature of this challenge [30,31].

A second feature concerns *global reach*. That is, emissions from all over the world contribute to the problem, so a cooperative response is needed [32]. Each country requires some assurance that other nations will do their share. But in the absence of a global sovereign, and considering the great diversity of national circumstances (where countries have different responsibilities for generating the problem, vulnerabilities to the changing climate, and resources to adapt and support mitigation), cooperation is elusive [26,33]. This feature also underscores the complex interactions among the multiple scales at which climate responses are being enacted and contested [34].

A third feature revolves around *distributional implications*. The impacts of climate change, and of the climate policy response, will vary across states, regions, economic sectors, firms, and social strata [35]. This relates to the distribution of costs and benefits as well as risks and opportunities across rich and poor countries [26,36] and multiple generations [37]. So, shifting arrays of economic, social, and political actors seek to influence the policy response in conflicts over ideas, interests, and identities [27].

A fourth feature surrounds *pervasive uncertainties*. Climate policy-making is plagued by uncertainty [38]. This is not just about the future of the climate system (e.g., climate sensitivity) or the impacts on humans and ecosystems of any given temperature rise, but also about the factors driving emissions growth (e.g., economic growth and demographic change) and influencing policy responses (e.g., international climate agreements, trade rivalries, economic shocks, geostrategic competition among great powers, the pace and direction of technological development, and unanticipated environmental impacts).

Finally, the problem involves *complex normative entanglements*. While all policy issues have normative dimensions, the array of interconnected value choices implicated in climate decision-making is particularly dense [39,40]. The comparative assessment of risk, the distribution of costs and benefits (across generations, regions, and social actors), and concern for human and ecosystem impacts have an irreducible normative dimension which underpins alternative approaches and policy frames [41]. Since there is not simply one low-carbon trajectory – there are a multitude of potential low-carbon futures (with different technologies, social practices, patterns of distribution, and so on) – struggles about which of these futures is more or less desirable is a permanent feature of climate politics and policy [42–44].

The abovementioned features, which make climate change mitigation such a challenge for policy, are also underlying sources of policy instability (see Table 1). And, how the interplay of these features unfolds in relation to particular political systems across different scales and at distinct moments in time is variable. The confluence of these elements suggests that a substantial degree of instability in climate policy responses is therefore unavoidable.

Beyond the abovementioned sources of instability, however, the transformative nature of the low-carbon transition itself makes excessive attachment to particular policy frameworks, targets, and

Table 1
Structural sources of instability in climate policy.

Structural sources of instability	Potential effects
1) Operative timeframes	Policy weakened or reversed as short-term political priorities change (e.g., retrenchment of clean energy policy in the United Kingdom under Conservative austerity)
2) Global reach	Policy adjusted to align with international climate ambition (e.g., national climate responses weakened in the face of Trump administration policy direction)
3) Distributional implications	Policy weakened or reversed as opponents of robust climate policy swamp proponents (e.g., mobilization of fossil fuel interests challenging the Clean Power Plan in the United States)
4) Pervasive uncertainties	Policy revisited based on emerging technological trends, learning, and external shocks (e.g., rapid decline in global price of solar energy changes playing field)
5) Complex normative entanglements	Policy reoriented given the negotiation of underlying values (e.g., Germany's value judgement that nuclear will not play a role in the low-carbon transition)

instruments (or even portfolios of specific instruments) inappropriate. Over the past two centuries, fossil fuels have become the cornerstone of human civilization, literally fuelling modern economies and lifestyles [45]. Consider, for instance, how: the design of cities and norms about travel have developed alongside the diffusion of the gasoline-powered automobile [46,47]; notions of comfort have become entwined with energy-intensive indoor heating and cooling [48,49]; and, important political and economic interests have cemented around fossil fuel-based resource exploitation [50] and electricity generation [51].

Given the degree to which carbon-intensive technologies and practices have become embedded in present-day society, movement toward a low-carbon future implies long-term and transformative change to interconnected social and technical systems such as transport and agriculture, spanning technological innovation trajectories but also lifestyles, business models, institutional structures, as well as economic and political arrangements [52,53]. Put differently, a low-carbon transition involves radically readjusting how societal functions are met in such a way as to disentangle and displace carbon-intensive technologies and practices from "the way we do things". This scale and scope of readjustment is not possible for policymakers to anticipate in advance and will involve considerable disruptions to the established systems underlying current policy frameworks [54,55]. In this context, existing policy domains are likely to become increasingly unrecognizable from today's circumstances as the way we transport people and goods, produce and distribute energy, and feed and house populations fundamentally transform. It also suggests that entirely new policy domains can be expected to open (consider, for instance, how the diffusion of information and communications technologies has had and continues to have cascading impacts on regulatory and policy frameworks). In this way, climate policy will at the very least need to adapt to changing circumstances, but will also need to be continually reinvented to keep pace with different phases of the transition [56] as well as novel and unanticipated avenues of social and technological development. Take, for example, how blockchain technologies and digital currencies are beginning to reshape energy consumption and associated impacts on climate systems [57] or how a change in diet could transform land-use patterns [58]. This is to say nothing of the even more unexpected and radical possibilities that could help redefine systems of social and technological organization.

And so, instead of striving for stability as an overriding feature of climate policy, we suggest attending to a much broader aim: *stabilizing the overarching orientation of climate policy as a transition towards a low greenhouse gas emission economy*. This shift in emphasis acknowledges that a low-carbon transition is unfolding and will have transformative implications, that climate policy will remain in flux yet must propel movement in a low-carbon direction, and that societal actors would do well to adjust their actions to align with this overarching direction of change. In this view, while specific climate policies may come and go, the general direction of change should remain constant over the long-term.

To be sure, the above emphasis on the orientation of policy as opposed to set policy instruments or frameworks does not offer the specificity and concreteness some would argue is needed to gradually reorient the actions of businesses and individuals (as a carbon pricing system might do by signalling steadily rising stringency, for instance). Still, even in the absence of such a framework, investors and businesses are already beginning to account for exposure to carbon risk and integrate a shadow price for carbon in their decision-making [59,60]. These efforts by the private sector are not meant to anticipate a specific configuration of future policy instruments but rather account for a range of potential responses that could be enacted to move toward a low-carbon future (e.g., a combination of regulatory measures, carbon pricing systems, and sector-specific policies). In this way, this analysis is predicated on the notion that the stability of the overarching direction of policy as a low-carbon transition is at least of equal importance to the specific policies in place at any given moment in time. We now turn to the conceptual review in order to identify lessons and distill strategies for addressing this aim.

3. Conceptual review: Path dependence, policy feedback, and transition pathways

Path dependence and *policy feedback* have attracted considerable interest as useful concepts for engaging with policy stability and discontinuity. Indeed, "the related concepts of policy feedback and path dependence have become central to the study of the politics of public policy" ([61] p.441). While these concepts can be traced back to diverse bodies of literature [13,14,62–66], here we focus on their applicability to the climate policy field [8,11,15,19,26,67–69]. "*Transition pathways*" has similarly emerged as an important concept for engaging with the deep complexities and uncertainties surrounding the pursuit of decarbonization [42,43,52,70–72]. Based on a survey of these core concepts, we distill three central lessons in this context: (1) *early sequences of choices can set in motion self-reinforcing courses of development*; (2) *policy choices are a particularly important way in which self-reinforcing patterns of development can be enacted*; and (3) *while early choices matter, it is the cumulative sequence of choices over time that helps shape outcomes*. These lessons guide our formulation of strategies to strengthen the directionality of the low-carbon transition presented in Section 4.

3.1. What is path dependence?

Path dependence relates to the notion that choices taken at an earlier point in time can set in motion a particular course of societal development that can affect choices far into the future [65]. This process often manifests as a kind of historical inertia, whereby early choices close down the envelope of possible future choices in such a fashion as to reproduce established societal arrangements [69]. Stated differently, "preceding steps in a particular direction induce further movement in the same direction" ([13] p.252). In this view, positive feedback (or self-reinforcement) is the central feature of path dependence as each step in the same direction makes it increasingly difficult to reverse

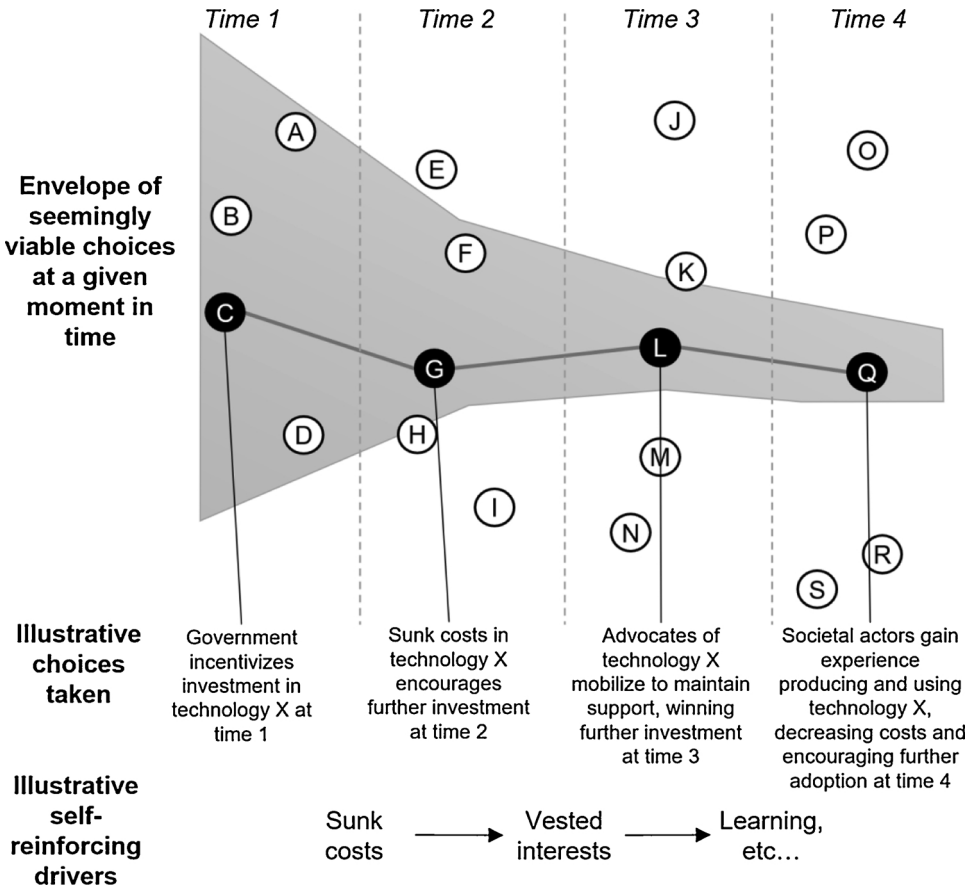

Fig. 1. Schematic representation of a path dependent process.
This figure illustrates how early sequences of choices can set in motion a course of events that becomes self-reinforcing over time.

course [73]. This process can appear to "lock in" certain technological and institutional arrangements given: (1) the sunk costs associated with the current system, (2) the accumulation of experience around established technologies and institutions, (3) self-fulfilling expectations about the persistence of these arrangements, and (4) increasing benefits of moving in the established direction – e.g., standardization and access to financing [12]. Beyond these four drivers of path dependence, patterns of self-reinforcement also occur because specific institutions and technological arrangements tend to become accepted as natural the longer they are in place [13], possible alternative institutional and technological trajectories are not equally viable at any point in time [15], and there are often positive feedbacks between an institutional setup and its beneficiaries – i.e., vested interests [14]. Fig. 1 provides a schematic representation of a path dependent process, illustrating how a sequence of choices can build momentum for a particular course of development, potential self-reinforcing drivers can encourage further movement in the same direction, and the envelope of choices may appear to narrow over time.

The central idea here is that *early sequences of choices can set in motion a course of events that becomes self-reinforcing over time*. Numerous historical cases of societal and technological development reflect this self-reinforcing pattern. The diffusion of the light water nuclear reactor, QWERTY keyboard, and VHS recording standard, among other innovations, were driven not by their technological superiority but because early choices and events created self-reinforcing trajectories that made selecting alternatives increasingly difficult [74,75]. Beyond these cases, path dependent processes have helped explain how different political and economic arrangements (from resource-based economies and high-tech sectors to specific forms of labor relations and market structures) have emerged and persisted given early choices and events [50,65,66,76]. Even the rise of particular political parties appears to be marked by path dependent dynamics [77]. With respect to policy, the entrenchment and stability of longstanding social programs [62,78] as well as economic subsidy programs and market deregulation initiatives [9] have also been linked to patterns of path dependence.

Understandably, path dependent processes are traditionally considered to be a barrier to the adoption of low-carbon innovations. They explain how early policy choices and investments in carbon-intensive technologies have helped lock in further movement in this direction despite the subsequent availability of more environmentally desirable alternatives [12]. Yet, while early choices have set in motion self-reinforcing sequences of carbon-intensive development, there is now a growing body of research suggesting that it is equally possible to harness path dependent processes to make low-carbon policy more durable and to ramp up stringency over time [11,16,19,26,79].

3.2. What is policy feedback?

A particularly important way in which path dependence can manifest is through policy choices. In marked contrast to models of policy development which view policy as the unidirectional result of politics, *policy feedback* is concerned with the "impact of previously enacted policies on future political behavior and policy choices" ([62] p.570). Put differently, "[e]xisting policies define the political environment, shaping the capacities, interests, and beliefs of political elites and states and therefore the outcomes of subsequent rounds of policy making" ([63] p.334). Policy and politics, in this view, have a bidirectional relationship with early policy choices influencing later rounds of political debate and policy selection.

Pierson [14] has helpfully outlined two prominent effects through

which policy feedback can manifest: (1) resource and incentive effects and (2) interpretive effects. With respect to the former policy feedback effect, policies provide incentives and resources that may modulate the creation or expansion of particular groups. Policies, in this view, can "activate" or "empower" different constituencies and interests by building government capacities (e.g., enhanced monitoring capabilities) and augmenting resources (e.g., access to decisionmakers and creating forums for actor organization). Similarly, government can also more directly advantage particular interest groups through policy (e.g., research funding, attractive financing arrangements, tax measures, and procurement). The beneficiaries of a policy – also commonly referred to as "instrument constituencies" – can, in turn, be expected to mobilize during subsequent rounds of political debate in order to support and attempt to expand their favored programs and institutional arrangements [80,81]. Consider, for instance, the way in which particular industrial strategies around nuclear power have created powerful networks of interests that now mobilize to protect their endowments and favored positions in policymaking processes. Indeed, policies "create powerful packages of resources and incentives that influence the positions of interest groups, government elites, and individual social actors in politically consequential ways" ([14] p.610).

Interpretive effects, on the other hand, relate to the more cognitive implications of policies [14]. In this understanding, policy frameworks can activate particular interests by framing problems in certain ways. Take, for instance, the difference between framing climate change in terms of "climate justice" versus a shift to a "green economy". The former emphasizes the distributional impacts of climate change and presents a greater role for actors concerned with equity and marginalization. The latter, in contrast, frames the challenge as one of reconfiguring the economy and creates much larger openings for incumbent firms in driving low-carbon change. Through framing, policies can therefore play a role in constructing and constituting the political identities of the groups they impact [82].

Importantly, these effects can cultivate positive (self-reinforcing) but also negative (self-eroding) feedback processes. A policy may, for instance, have latent but gradually rising fiscal commitments that limit its continuation [62,83]. Equally, policies may activate groups that mobilize around its reversal in subsequent rounds [16]. Consider, for example, how curtailing the authority of local planning bodies may intensify controversy around renewable energy deployment policies as their diffusion increases [84]. Still others point to interpretive effects associated with emphasizing the adverse impacts stemming from a policy [61] or that prevent groups from identifying with a policy [63]. Take, for example, how framing policy support for emerging renewables as either "subsidies" or "investments" may limit or encourage the formation of coalitions willing to link their identities to these programs [85].

To date, the concept of policy feedback has largely been used in explaining the careers of social policy, often emphasizing unintended feedback effects [23]. There are some notable exceptions, however, that consider the way in which policy might deliberately be used to cultivate positive feedback effects for the pursuit of decarbonization. Meckling et al. [17], for instance, show how the adoption of green industrial policies may encourage the emergence of coalitions supportive of greater climate policy stringency in latter rounds of policy debate. Others have noted that investing in disruptive low-carbon innovations (e.g., decentralized applications of solar photovoltaics) may promote positive feedback effects for further climate action by undermining the privileged position of incumbent players, highlighting how policy feedback processes can unfold through technological change [18]. In this way, it is not only appropriate to consider how policy might help perpetuate or erode itself, but also how it might undermine or promote more ambitious movement in a low-carbon direction over time (Fig. 2 summarizes these dynamics).

3.3. What are transition pathways?

Path dependence and policy feedback reveal how an early set of choices can have long-term repercussions for the pursuit of decarbonization and that these repercussions merit attention as part of policymaking. The concept of *transition pathways* complements this thinking, embracing path dependent processes and feedbacks to contemplate broader transition dynamics that move beyond the careers of particular policies or technologies. This concept has principally been used to grapple with the patterns of, and opportunities for, unlocking path dependencies surrounding unsustainable orientations and arrangements [52,53,86]. That is, how society might begin to veer toward more sustainable and low-carbon courses of development. The concept underscores the: multiple directions and processes of low-carbon change; interactions among technological, social, and natural dimensions; and, cumulative choices spanning several decades [71,72,87].

While diverse research communities have emphasized different aspects of transition pathways to consider alternative possible low-carbon futures and identify robust responses [70–72,87–89], it is understood that multiple choices (e.g., the adoption of particular institutional commitments or investments in specific technologies and infrastructure) at distinct moments in time will need to be strung together to realize a low-carbon transition, and that this process can be encouraged by attending more carefully to the potential trajectories suggested by alternative choices [43,70,90]. In this fashion, transition pathways can be thought of as being constituted by self-reinforcing sequences but also *punctuated by branching points*, which offer actors the opportunity to reinforce the original trajectory or veer toward alternative directions [42]. This highlights that while early choices may create self-reinforcing courses of development that close down or open up certain possibilities in the future, later choices may still undermine (or further reinforce) these directions [44]. Recognizing the existence of certain self-reinforcing processes may also help in breaking away from rigidities and opting for alternative trajectories [86,91]. And so, it is *the cumulative interaction among early and later choices that help define a low-carbon transition pathway* (see Fig. 3).

This sequential pattern of development is illustrated by a number of prominent episodes of low-carbon change such as the coal phase-out in Ontario, Canada [92,93] – the single largest greenhouse gas emissions reduction measure in North America, to date [94]. At the outset of the coal phase-out in 2003, an initial policy decision was taken by the newly elected Liberal government, which framed the issue in terms of salient environment-health impacts and created space for political interventions by environmental and health advocacy groups [93]. This decision was reinforced by mounting environmental concerns as well as earlier choices (e.g., the choice to retain public ownership of coal-fired facilities and shutdown the Lakeview coal-fired generating station near Toronto by 2005), but these forces were not sufficient to drive full implementation on their own. The phase-out encountered mounting challenges tied to reliability and economic concerns (e.g., employment losses at the affected plants). Alternative options were proposed such as the installation of scrubbing units to remove particulate matter and keep the coal plants in operation. In response, successive choices were taken to neutralize concerns – delaying the shutdown of coal units until other sources could be brought online along with converting some coal units to burn biomass. In this fashion, there were challenges at each step and opportunities to begin to veer away from the initial policy direction despite its momentum. Later choices helped lend strength to the initial plan and defuse resistance, promoting the stepwise shutdown of the remaining coal-fired units [94].

Thinking in terms of transition pathways, therefore, not only underscores the importance of cumulative policy and technological choices for the overarching low-carbon transition but also illustrates that there are multiple and potentially interconnecting ways to get from current systems to a variety of low-carbon futures. While early self-reinforcing sequences lend strength to established trajectories and make

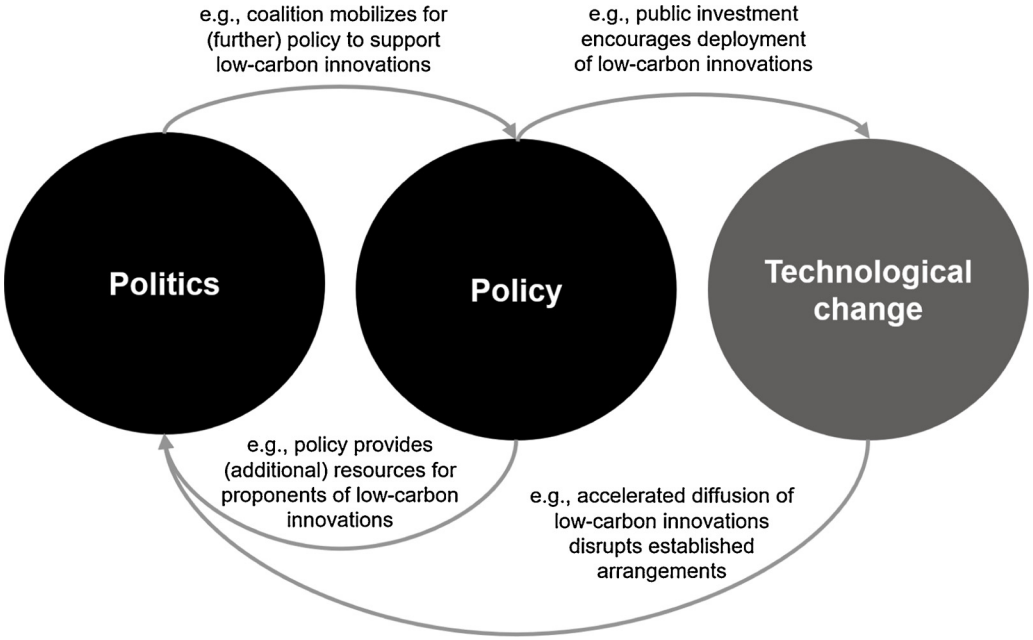

Fig. 2. Illustrative representation of policy feedback processes.
This figure is adapted from Schmidt and Sewerin [18]. It illustrates how policy choices (e.g., investing in low-carbon innovations) can create feedback effects (e.g., resource effects that augment the capabilities of the proponents of low-carbon innovations) in such a way as to help shape political and policy dynamics in subsequent rounds of action. In this example, a potentially self-reinforcing feedback process is presented.

certain choices more or less viable at any given time, later choices at branching points can be of equal importance for defining long-term decarbonization pathways [43]. In this way, transition pathways bring near-term policy choices into dialogue with long-term directions of low-carbon change. This may, in turn, help in integrating path dependence and policy feedback as well as assessing whether and how certain choices might be critical or not in pursuing decarbonization.

4. Strategies to help stabilize a low-carbon policy orientation

What does this discussion suggest about potential strategies to help stabilize a low-carbon policy orientation? Much of the literature on climate policy stability has, to date, adopted a relatively tactical posture that emphasizes tweaking the design of specific policies (or mixes of instruments) to activate self-reinforcing processes to stabilize the application of a particular instrument. Lazarus [26], for instance, points to the use of automatic triggers that may penalize policymakers for failing to move to implementation or meet objectives on time. Perhaps most notably, recycling revenue from carbon pricing systems is often highlighted as a central means to build instrument constituencies for climate policy and to buy off political opponents [11,15,79,95,96]. Policy reversal, in this case, would involve upsetting government revenues along with the endowments of various societal interests. While these tactical and instrument-level considerations may have a role to play in consolidating support for particular policy instruments and ratcheting up climate policy stringency over time, we focus on broader forward-looking strategies that aim to reinforce the low-carbon transition.

Based on the discussion above, we distill four prominent strategies to help stabilize the overarching climate policy orientation*: (1) embed the low-carbon transition in a broader transformative agenda, (2) build societal legitimacy for climate policy, (3) encourage the growth of constituencies with a material interest in climate-friendly transformations, and (4) create a supportive ecosystem of institutions*. These strategies are not meant to be exhaustive or mutually exclusive. Ideally, they would function together to reinforce a low-carbon course of development. The following discussion details each of the strategies and provides some illustrative examples.

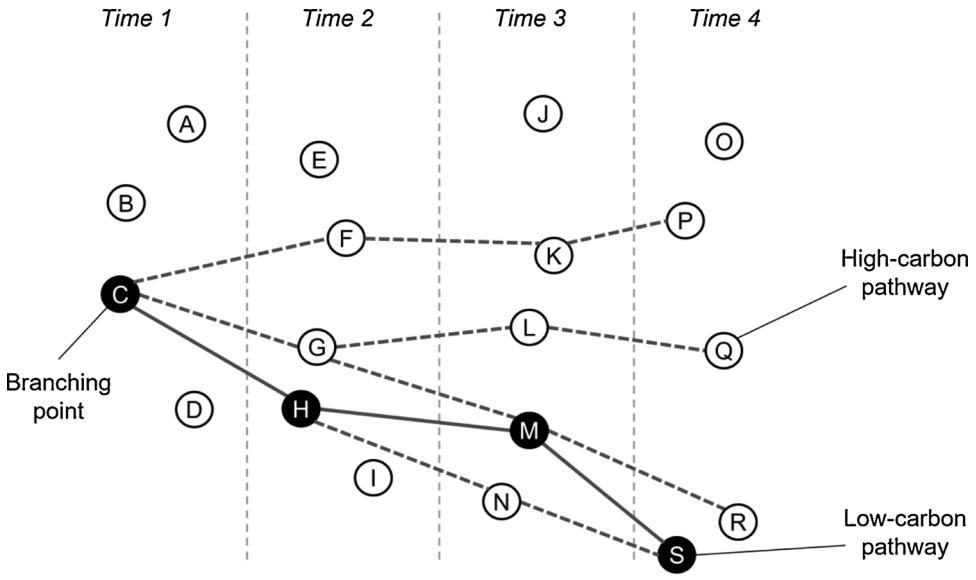

Fig. 3. Sequences of choices, branching points, and low-carbon pathways.
This figure illustrates how sequences of early and more immediate choices can help define a low-carbon pathway. Solid lines depict the path taken and dotted lines represent alternative trajectories available at branching points, which may open alternative courses of societal development.

4.1. Embed the low-carbon transition in a broader transformative agenda

A strategy of deliberately embedding the low-carbon transition in larger processes of transformative change has important implications for both (1) the *framing of public discussion* and (2) the *deployment of policy instruments*. With respect to the former, this strategy suggests more explicitly recognizing the transformative nature of the low-carbon transition. This transition embraces a series of long-term and radical adjustments at different scales and across an array of human systems such as transport, electricity, and agriculture. Climate considerations alone have not yet proved sufficiently salient to motivate this depth of change. And yet, there are already disruptive forces driving transformative processes within many of these systems (think, for example, of self-driving vehicles, new ridesharing business models such as Uber and Lyft, as well as the shifting attitudes of young people towards vehicle ownership, that threaten to upturn the personal mobility sector). Even in areas where disruption is not immediately evident, there are latent possibilities – unmet needs, problems that have eluded solution, and opportunities to make welfare gains. In this way, the challenge for climate policy is how to harness these change processes so that it can unlock existing systems and open space for change that can meet aspirations for social improvement, while *simultaneously* addressing climate considerations. In other words, this strategy involves *integrating* climate policy more closely into the attainment of other desirable societal objectives (e.g., a better transport system, more livable cities, and healthier food) in order to strengthen the drivers for change and directionality of decarbonization.

As part of this reframing effort, there is merit in further emphasizing the shortcomings of existing ways of doing things, identifying disruptive forces, and co-developing compelling visions and pathways to move to more desirable states. Thus, climate policy becomes less about efficiently chasing tons of greenhouse gas emissions reductions or punishing environmental “bads” and more about the improvement of societal systems, modernization, social gains, enhanced fairness, and so on. Integrative solutions of this kind are already being carried out in many contexts – e.g., the level of specific projects and in cities [97] or as part of low-carbon development strategies [98], which explore opportunities for economic and social progress in the context of a carbon constrained world. However, here the challenge for climate policy is not just to integrate varied societal priorities but also to unleash and deliberately harness disruptive forces.

It is sometime suggested that such an approach can make climate policy *more* difficult because it seems to introduce added complexity as compared to a simple focus on incremental emissions reduction. However, more integrative approaches can help broaden coalition building opportunities [99] and make change more accessible.

This strategy suggests that the emphasis on carbon pricing as *the* critical instrument of climate policy is seriously misplaced. To be sure, carbon pricing can provide an important economy-wide signal. However, taxation tends to be a controversial issue for governments and it has proven ripe for manipulation by opportunistic political leaders. Many jurisdictions have had trouble implementing national pricing schemes (e.g., Canada, USA, and Australia), and even where schemes are in place the carbon price remains well below levels needed to induce significant change (e.g., EU). The infatuation with “efficient climate policy” (hardly practiced in other policy domains) has deflected attention from effective climate policy. By “effective”, we mean a set of sector specific policies that can induce qualitative change in key systems (e.g., transport, agriculture, and electricity) over the medium term. After all, each of these systems has its own operating logics and constellations of actors; the drivers and barriers for change are distinct; and the reform coalitions and policy packages which can most effectively unlock change are different.

4.2. Build societal legitimacy for climate policy

While the integrative approach outlined above will help to enhance societal legitimacy for climate action by reframing it as part of a move towards better overall outcomes, attention should also be paid to strengthening public support for policy interventions *specifically* directed at addressing climate change. In the absence of such efforts, climate considerations could be considered an “optional extra” in welfare enhancing packages of system reform. Here a core challenge is to embed the low-carbon transition into social and cultural consciousness.

Despite over three decades of discussion, in many countries public understanding around climate change remains remarkably weak [100]. Government communication often promotes specific policy initiatives (e.g., carbon pricing measures), while remaining relatively opaque about the nature of the climate problem and the scale of change required. Note, for example, that the Paris agreement was the first international accord to explicitly signal the goal of net-zero emissions.

There is now an increasingly sophisticated literature on climate communication which explores public receptivity to climate messaging, points to the importance of identity, trusted intermediaries, and political partisanship, and establishes that simply giving people more facts about climate risks does not necessarily translate into support for policy action [101,102]. More attention should be paid to the lessons of this work in designing public education around climate change [103].

Still, key elements which need to be more generally appreciated if climate policy is to become less volatile include: the basic causal chain, risks, and uncertainties associated with the climate problem; the scale of adjustment required to deal with the issue – i.e., full decarbonization; a transition perspective, anticipating deliberate movement over several decades to shift established patterns of production and consumption; an appreciation that we already have (and are deploying) technologies and social practices to get this transition moving, although further innovation will be required; that acting on climate change will not destroy our way of life or cherished institutions; that climate policy (adaptation and mitigation) presents opportunities to build better infrastructure, systems, and societies; and, that defining the contours of a desirable and climate-friendly future is open to all.

The point here is not so much that these elements are appreciated intellectually but rather that they are embedded in institutions, practices, and socio-cultural understandings. That they are linked with citizen, occupational, regional, and national identities – becoming part of “who we are”, “how we do things here”, and aspirations for the future. Sentiments of this sort relating to democratic norms, welfare institutions, or development goals have been embedded in collective identity in many countries (e.g., [104]). National identities are also beginning to become similarly enmeshed with climate policy experiences in certain jurisdictions [105]. Importantly, these identities are not permanently fixed but are instead continually struggled over and reconstructed.

There are many ways to build such a consciousness by: enhancing community engagement around climate issues; adjusting school and university curriculums, mobilizing professional groups; harnessing the arts, culture, celebrity, and faith-based organizations; deploying widespread transition experiments and demonstrations [106], and so on. Policy can build such consciousness by setting expectations [107]. Thus, for example, fixing a date after which new internal combustion engine vehicles will no longer be legally sold (as France, the Netherlands, and Germany recently announced) helps signal that change is coming.

4.3. Encourage the growth of constituencies with a material interest in climate-friendly transformations

To the extent that climate change mitigation is successfully embedded in a broader agenda for the improvement of societal systems, a wide range of groups will receive enhanced material benefits. For

example, homes will be more comfortable, electric vehicles will have lower running costs, health outcomes will be enhanced, and cities will be nicer places to live. Such material improvements can strengthen public support for change. However, here we are thinking particularly of the constituencies directly involved in supplying new products and services critical to a low-carbon economy (the entrepreneurs, investors, workers, and businesses as well as the communities where they are based).

The operation of the modern political economy and representative democratic institutions provide tremendous structural power to established economic interest groups. Their activities are linked with job creation, export earnings, tax revenue, and generating economic growth. Over time, existing incumbents have developed close ties to the policymaking apparatus and shaped a policy landscape conducive to their business models, and show little hesitation in exerting political pressure to defend their interests [108]. So, building countervailing power (businesses, trade unions, and producer groups) with a direct interest in upsetting existing models and deepening the low-carbon transition is critical, both to check the resistance of incumbents and to push for reconfiguring the policy space to favor low-carbon technologies, services, and business models. In this way, policy has an important role to play in encouraging the creation of new interest constituencies and facilitating their self-organization. As these constituencies grow in strength, they can mobilize around policies that further accelerate the transition [23]. Of course, there are always risks that emerging business groups deploy their strength to capture the policy process (to lock in particular technologies or subsidy programs) and prevent further evolution towards socially desirable outcomes. Yet, breaking the stranglehold of now dominant interests is essential, and policymakers can be alert to potential risks and act accordingly.

Through green industrial policy, Germany has for instance been quite successful in developing a renewable energy industry that has mobilized to secure political victories in later rounds of policy debate [109]. Over the past two decades, Germany has adopted renewable energy deployment programs (e.g., feed-in tariffs and more recently auctions) and set ambitious renewable energy targets. Meckling et al. [17] corroborate the centrality of green industrial policy, suggesting that it has been instrumental in building momentum for more ambitious decarbonization strategies in later rounds of action.

4.4. Create a supportive ecosystem of institutions

Stability of the overall orientation can also be enhanced by building networks of institutions that can mobilize resources, develop specialist expertise, implement systematic programs, and to some extent resist the vagaries of short-term political cycles. Such institutionalization is necessary both within and outside government. Here the goal should be understood less in terms of building a hierarchical structure to implement a comprehensive plan and more in terms of creating a supportive ecosystem to advance climate policy and the low-carbon transition over the longer term.

Institutional design is notoriously complex and context dependent. Creating a supportive institutional setup to help stabilize a low-carbon policy orientation requires: (1) adapting existing institutional mechanisms and (2) creating purpose-built organizations that fill novel functions. While many of these institutional centres will necessarily lie within government, as states possess critical levers (law that alters regulations or property rights, the power of taxation, and legitimacy) that can accelerate transitions, it is important not to neglect the significance of quasi-independent bodies that operate outside direct ministerial control (though they may receive substantial government funding). The latter include parliamentary advisory bodies, arm's length agencies, independent research bodies and think tanks, publicly funded trusts, joint public/private/not-for-profit partnerships, and so on. The advantages of such organizational forms are many: they are somewhat insulated from everyday political interference; can move quickly to exploit opportunities; and can build their own independent reputations for effectiveness and objective judgement.

One way to appreciate the significance of the institutional dimension is to consider the governance functions that need to be secured in order to accelerate the low-carbon transition. At the highest level, these include: formulating strategic guidance, empowering technological and social innovators, deploying financing, engaging with the public, supporting research and development, and carrying out assessment and monitoring. Different organizations within and outside government can perform multiple functions at different scales and across different contexts. For example, climate and transition related research can be integrated into the mission of government research facilities, linked into the funding mandate of research councils, while serving as the focus for the establishment of independent research institutes conducting applied work on low-carbon economic development. From these new institutes, new data and research could emerge but also skilled policy communicators and novel messaging strategies that may help to drive climate engagement [110].

One could envision creating new institutional requirements modeled after the UK carbon budgeting process [111] or other similar setups [112], with obligations to plan for and report on near-term emission limits. This would involve building new capacity around climate change policy and planning, implementation and alignment (ensuring consistency across government responses), monitoring and reporting, as well as data collection and communication. Some of these functions could be housed within government, whereas others may be located with nongovernmental organizations or arm's length bodies (perhaps akin to the UK Committee on Climate Change).

Inevitably there will be some redundancy and overlaps in such an ecosystem, and some competition and jostling over spheres of operation. Certain groups may fail to achieve defined objectives, while others will expand more quickly than anticipated. But the goal is a system of organizations of diverse types, with different remits, which *taken together* accelerate change towards a low-carbon future. In addition to the specific functions each of these groups performs, collectively they contribute to a complex and protracted transition towards the carbon emission free economy.

In this way, institution building represents an important social complement to material forms of sunk costs (building infrastructure) given that institutions become increasingly difficult to dismantle the longer they have been in place and as they begin to take on important roles and become interconnected with public and private sector actors at all levels.

5. Concluding remarks

This paper has argued that climate policy stability may not only be unattainable in the face of pervasive sources of instability but also undesirable given the transformative nature of the low-carbon transition. Attempts to instill climate policy with durability are complicated by the structural features of the climate challenge that manifest as sources of instability, including operative timeframes, global reach, distributional implications, pervasive uncertainties, and complex normative entanglements (see Table 1). And, even more fundamentally, shifting away from carbon-intensive arrangements entails a transformative social and technological reorganization as fossil fuels have become deeply embedded in the fabric of society. Rather than striving for stability as an overriding feature of climate policy in this context, we have proposed a broader aim: *stabilizing the overarching orientation of climate policy as a transition towards a low greenhouse gas emission economy*. This shift in emphasis requires a change of posture from the shorter-term tactical level of instrument (mix) design to the longer-term strategic considerations that underlie the overarching orientation of policy.

To address this aim, the paper has reviewed three complementary concepts that have shown particular promise engaging with

decarbonization: path dependence, policy feedback, and transition pathways. From this, four interrelated strategies for stabilizing a low-carbon policy orientation have been identified: (1) embed the low-carbon transition in a broader transformative agenda, (2) build societal legitimacy for climate policy, (3) encourage the growth of constituencies with a material interest in climate-friendly transformations, and (4) create a supportive ecosystem of institutions. Given the connections among the above strategies, they can be anticipated to interact as climate policy engagement unfolds over time to create mutually supportive self-reinforcing feedbacks driving more accelerated processes of change. Caution is also merited, however, as strategies could interact negatively and create self-eroding feedbacks if not deployed appropriately. Consider, for instance, how overly generous efforts to build supportive constituencies may create a backlash against more ambitious climate action in later rounds if these efforts are not linked to a compelling transformative agenda with broad-based appeal.

As part of this, the analysis warns against defining climate action too narrowly in terms of individual policy measures or frameworks (e.g., a carbon pricing system). Framing the climate challenge in such a way runs the risk of tying climate action in general to the career of a single policy, whose delegitimization could act as a powerful political symbol to avoid further responses. Rather, the implication of what is proposed here is to begin weaving climate policy throughout multiple policy fields, linking to numerous complementary societal priorities, and embedding within supportive institutional setups. And, in this way, a low-carbon policy orientation may over time become an accepted part of the core functions and priorities of government in seeking to realize a desirable (and low-carbon) future.

This paper also calls attention to the uneasy tension between much of the discourse around climate "policy stability" and the overall goal of initiating "transformative change". Business interests claiming to be in favor of climate action may, for instance, stress the need for stable climate policies to drive down emissions and provide certainty around investments, and yet often actively resist the kinds of disruptive changes entailed by a low-carbon transition. Internalizing the concerns of these interests, decisionmakers have given particular weight to the stability of climate policy, while tending to obfuscate the transformative implications of meeting climate commitments. In this vein, some of the academic literature may also foreground stability without always clarifying what exactly is to remain stable and what is meant to change [113] – e.g., certain policy measures and frameworks, or goals and targets, or practices and lifestyles, or technological configurations and innovation trajectories. Attending more closely to this tension may allow scholars and practitioners to disentangle policy stability efforts that have little logic for system-wide transformative change from those that might accelerate broader transition processes.

Beyond this, the above strategies also represent new horizons for research focused on broader notions of stabilizing a low-carbon policy orientation. While we have identified a number of ways that the proposed strategies might operate, there is clearly a need for further research to explore how best to enact and achieve these strategies, how to assess efforts and track progress against them, and what implications and trade-offs they present for the decarbonization challenge. Indeed, each strategy can be reformulated in terms of questions for policy and future research (e.g., how might policy best create a supportive ecosystem of institutions? what functions are critical to such an institutional framework? which actors and organizations would be most effective in carrying out these functions? what are the complementarities and tensions between climate and non-climate frames in particular contexts? who would be most appropriately situated to communicate these frames and develop compelling transformative visions?). As part of this, additional thought could be given to indicators that might be used to assess progress against strategies. Moreover, there is merit in further attending to the way in which strategies may interact with one another over time, with a view to unlocking mutually supportive self-reinforcing dynamics. Taken together, the challenge of stabilizing a low-carbon policy orientation represents fruitful terrain for future research.

Conflict of interest

The authors have no conflicts of interest to declare.

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